Art. I.—*On a Palaeozoic Serpentine Conglomerate, North Gippsland.*

By E. O. THIELE.

(With Plate I.).

[Read 9th March, 1905].

The conglomerate under consideration belongs to a serpentine belt and associated series of basic igneous rocks of undetermined area. It is situated in the parish of Dolodrook, county of Wonnangatta, about 7 or 8 miles in a straight line west from Mt. Wellington. The country is rough and precipitous, so that the very short time available for examining the occurrence did not permit of any attempt being made to trace the boundaries of the serpentine and igneous rocks. This series of rocks, however, apparently forms a belt of no great width, and stretches south-easterly from a point about a mile-and-a-half south-east of the junction of the Wellington River with a stream which it is proposed to name the Dolodrook River. This tributary enters on the left bank of the main stream, but is unfortunately locally known as the Right Branch of the Wellington. Mr. R. A. F. Murray, in his report on the "Geology of South-East Gippsland,"[1] mentions the fact that he was unable to investigate the area immediately to the west of Mt. Wellington, but that it was nearly certain to afford geological features of interest, as he had heard of the occurrence of serpentine from that district, and that the sample of chrome iron ore mentioned in Progress Report, No. III., p. 172, came from the same place. The rocks of the greater part of the Mt. Wellington district consist of coarse red to chocolate coloured conglomerates, sandstones, finer shales and a varied series of igneous rocks forming an extensive Upper Palaeozoic belt, extending north-westerly across the Main Divide to Mansfield.

1 Progress Report, No. V., Geol. Surv. Vic., p. 57.

This series has been described as Devonian, but the northern portion is now generally accepted as Carboniferous, chiefly on account of the revision of the fossil fish from the Mansfield district by A. Smith Woodward, LL.D., F.R.S.[1] As, however, our knowledge of the relation of the southern part of this region to the Mansfield series is scanty, it is thought preferable at present to refer to the rocks of the Mt. Wellington series as simply Upper Palaeozoic.

At the junction of the Wellington River with the Dolodrook River, the writer obtained a series of well preserved graptolites from highly inclined black slates. These fossils have been handed over to Mr. T. S. Hall, M.A., who intends to work them shortly. Mr. Hall says that these graptolites represent an undoubted Upper Ordovician age, and, as the associated rocks were traced for some miles along the Wellington River and also observed in numerous sections along the Dolodrook River, an extensive inlier of Ordovician rocks is thus shown to exist in the Upper Palaeozoic area. The older rocks are much folded and in places show faulting accompanied by considerable crushing and crumpling. The Upper Palaeozoic rocks show little disturbance and rest unconformably on the Ordovician series with a general prevailing dip westerly, in this locality, at a low angle.

The observations in the serpentine area were confined principally to an interesting conglomerate noted at the north-west end of the serpentine belt.

The occurrence was reached by following up the Dolodrook River from its junction with the Wellington for less than half-a-mile, and then branching off to the left up a small steep tributary gully, locally known as Black Soil Gully. This small creek owes its name to the fact that there is a considerable accumulation of black soil filling up the upper portion. The soil has evidently been derived mainly from the decomposition of the serpentine rocks, but also contains numerous small flakes of indurated black slate. Along the serpentine occurrence the black to reddish colour of the soil forms a marked contrast to the barren nature of the Ordovician rocks on either side.

Just above the head of Black Soil Gully there is a lower portion of a spur forming what is generally known as the Monu-

1 Brit. Assoc. Belfast, Sept., 1902.

ment Gap. On both sides of the spur in this vicinity and extending on in a south-easterly direction, the serpentine rocks can be traced. They appear to have been subjected to a considerable amount of mechanical deformation, so that a well defined foliated structure has been induced. The general trend of the planes of foliation is from the north-west to the south-east, and coincides generally with the strike of the Ordovician rocks. Local variations, however, were observed and further on where the chrome iron ore occurs the foliation was more easterly. That the rocks have been subjected to considerable movement, and probably torsion also, is shown by the polishing and slickensiding of the serpentine laminae. Smoothed and rounded boulders were abundant on the slopes of the spur and several were found which showed distinct grooving and striation, and apart from this feature the shape of many of the boulders was even more suggestive of ice action. These boulders were traced to parallel bands in the serpentine, the general features of which are of considerable interest.

The matrix is for the most part serpentine and contains rounded boulders up to six inches and more in length. The included rocks are of various kinds, those noted being, quartzite and other indurated rocks, micaceous schist and basic igneous rock. The boulders of the latter are for the most part either wholly or partially serpentinised. These are the softest rocks in the deposit and are the only ones that showed marked striations. Between the larger boulders, a finer grit is frequently found and the component particles of this portion of the deposit consist chiefly of rounded grains which are now serpentine. Some of the pebbles show distinct evidence of movement in the matrix and consequent slickensliding due to the abrasion by the finer grit. Mechanical deformation is well shown by one of the serpentine boulders which shows a structure similar to that induced by the squeezing of a partially dry ball of putty.

The grooving, and particularly the shape of many of the boulders when examined in the hand specimens, would suggest at once the ice origin of the material, but when the subsequent intense pressure, movement and torsion indicated in the rocks is taken into account the value of striation at any rate becomes less important. It is possible, however, as indicated by the shape of many

of the included boulders, that glacial action may be the original agency to which the origin of the conglomerate is to be attributed, but both the mechanical and chemical alterations which have taken place make the question a very difficult one to decide at present. The age of this deposit is at present also somewhat obscure, as no sections showing clearly the relation of the conglomerate to the Ordovician rocks or the Upper Palaeozoic series were observed.

Conglomerates are largely developed in the neighbouring Carboniferous rocks, but these differ markedly in lithological features from those of the serpentine area and, further, they usually show little mechanical disturbance.

The general coincidence of the foliation of the serpentine with the prevailing strike of the Ordovician rocks, which here are much folded and broken, points rather to the probability of the serpentine and associated rocks being Ordovician or older.

The conglomerate described appears to present some features quite distinct from those hitherto observed in other conglomerates of Victoria, and some of these are perhaps quite peculiar to this deposit. Serpentine is not a usual matrix of conglomerates; other instances may be known, but in the numerous descriptions of the serpentine occurrences of Great Britain, the Alps and elsewhere, I have been unable to find reference to a conglomerate of this nature.

These few remarks have been written to draw the attention of other geologists to the peculiarities of this deposit, in the hope that some of them may have an opportunity of examining the occurrence more fully and thus aid in solving some of its mysteries.